PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 08 June 2001 (08.06.01)	
International application No. PCT/IE00/00105	**Applicant's or agent's file reference** PE1124
International filing date (day/month/year) 13 September 2000 (13.09.00)	**Priority date** (day/month/year) 13 September 1999 (13.09.99)
Applicant MCLAUGHLIN, Michael, Joseph	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

11 April 2001 (11.04.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Elisabeth KÖNIG
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREA

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
PE1124		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IE 00/00105	13/09/2000	13/09/1999
Applicant		
FERNWAY LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

[ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

[ ] contained in the international application in written form.

[ ] filed together with the international application in computer readable form.

[ ] furnished subsequently to this Authority in written form.

[ ] furnished subsequently to this Authority in computer readble form.

[ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

[X] the text is approved as submitted by the applicant.

[ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

[X] the text is approved as submitted by the applicant.

[ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 1

[X] as suggested by the applicant.

[ ] None of the figures.

[ ] because the applicant failed to suggest a figure.

[ ] because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IE 00/00105

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M11/06 H04B3/23

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 605 107 A (AT & T CORP) 6 July 1994 (1994-07-06) the whole document	1-3, 5-14,19, 21-31, 33-42, 47,49-56
A	---	20,48
X	US 5 892 757 A (HANSEN CHRISTOPHER R ET AL) 6 April 1999 (1999-04-06) column 1, line 1 -column 4, line 26 column 6, line 33 - line 54 column 12, line 33 -column 16, line 22	1-4,7, 10-14, 19, 21-32, 35, 38-42, 47,49-56
	--- -/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 March 2001	30/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Brichau, G

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IE 00/00105

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 214 672 A (CHEN MICHAEL P ET AL) 25 May 1993 (1993-05-25) column 1, line 1 - line 57 column 19, line 23 - line 35	15,43

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IE 00/00105

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0605107 A	06-07-1994	US 5394392 A	28-02-1995
		CA 2102465 A	15-06-1994
		JP 6232937 A	19-08-1994
		MX 9307742 A	30-06-1994
US 5892757 A	06-04-1999	US 5579305 A	26-11-1996
		US 6094422 A	25-07-2000
US 5214672 A	25-05-1993	CA 2058450 A	07-10-1991
		EP 0476125 A	25-03-1992
		WO 9115900 A	17-10-1991

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
PE1125		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IE00/00105	13/09/2000	13/09/1999
International Patent Classification (IPC) or national classification and IPC H04M11/06		
Applicant FERNWAY LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11/04/2001	16.01.2002
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Moser, J Telephone No. +49 89 2399 7528

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IE00/00105

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-16 as originally filed

Claims, No.:

1-56 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2, 3, 6, 8, 9, 11-20, 22-24, 27, 28, 30, 31, 34, 36, 37, 39-48, 50-52, 55, 56
	No:	Claims	1, 4, 5, 7, 10, 21, 25, 26, 29, 32, 33, 35, 38, 49, 53, 54
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-56
Industrial applicability (IA)	Yes:	Claims	1-56
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: EP-A-0 605 107 (AT & T CORP) 6 July 1994 (1994-07-06)

D2: US-A-5 892 757 (HANSEN CHRISTOPHER R ET AL) 6 April 1999 (1999-04-06)

1.1 Document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (the references in parentheses applying to this document):
A method for transmitting data between respective first and second modems in a telecommunications system (figure 3) wherein data in one direction is transmitted at a higher rate than the data to be transmitted in the opposite direction (column 3, lines 48 to 52). The data transmission rates to be used are determined during initial contact (column 7, lines 23 to 35). When the backlog of data in the data buffer exceeds a threshold (column 5, line 41 and lines 47 to 50) the transmission rates might be reversed (column 5, lines 51 to 56). Furthermore, the use of PCM digital signals is disclosed (column 4, line 24).

All features of present claim 1 are thus disclosed in document D1. Claim 1 does therefore not meet the requirements of Article 33(2) PCT.

Furthermore, even if the applicant were to argue that on the basis of some minor amendments the claim was novel over the disclosure of document D1, it is clear that the claim is not inventive, contrary to Article 33(3) PCT, because document D1 deals with the same object (switching the data transmission rates in the forward and backward direction between a first and a second modem from a high rate to a low rate and vice versa) for the same purpose (accommodating varying volumes of data to be transmitted in respective opposite directions in a telecommunications system).

1.2 Furthermore, dependent claims 2 to 28 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, involve an inventive step for the reason that the subject-matter of said claims is either in principle directly derivable from the disclosure of document D1 (see for claim 4

figure 3; for claim 5 column 5, lines 13 to 27; for claim 7, figures 4 and 5; for claim 10 column 5, lines 57 and 58; for claim 21 column 7, lines 28 to 35; for claims 25 and 26 column 4, line 24) or represents simple design details which are generally known to the person skilled in the field of modem based telecommunication systems.

2.1 Independent claim 29 corresponds to claim 1 in terms of system features. It does therefore not meet the requirements of Article 33(2) PCT for the same reasons put forward with respect to claim 1 in paragraph 1.1.

2.2 Dependent claims 30 to 56 correspond to claims 2 to 28 in terms of system features. They do therefore not appear to contain any additional features which, in combination with the features of any claim to which they refer, involve an inventive step for the same reasons given for claims 2 to 28 in paragraph 1.2.

Re Item VII

Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.

Re Item VIII

Certain observations on the international application

The application does not meet the requirements of Article 6 PCT, because the category of claims 32 to 37 is not clear.
According to the PCT Guidelines, III-4.1 the wording of a claim should leave no doubt as to its category.
Claims 6, 7 and 8 are formulated as system claims but they do not only define the claimed apparatus. In addition, they define the functions to be carried out in terms which correspond to features of a method to be performed by the claimed apparatus (e.g. "*the selecting means of the first modem selects the high and low data transmission rates of the*

first modem").

In order to overcome this objection claims 32 to 37 should have been reformulated so that their features clearly fall into either category (system or method) by use of formulations like e.g. "*selecting means for selecting the high and low data transmission rates of the first modem*".

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 March 2001 (22.03.2001)

PCT

(10) International Publication Number
WO 01/20892 A3

(51) International Patent Classification[7]: H04M 11/06, H04B 3/23

(21) International Application Number: PCT/IE00/00105

(22) International Filing Date:
13 September 2000 (13.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
S990767 13 September 1999 (13.09.1999) IE

(71) Applicant *(for all designated States except US)*: **FERNWAY LIMITED** [IE/IE]; 63 Broomhill Drive, Tallaght, Dublin 24 (IE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **MCLAUGHLIN, Michael, Joseph** [IE/IE]; 12 Mount Eagle Park, Leopardstown, Dublin 18 (IE).

(74) Agent: F.F. GORMAN & CO.; 54 Merrion Square, Dublin 2 (IE).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

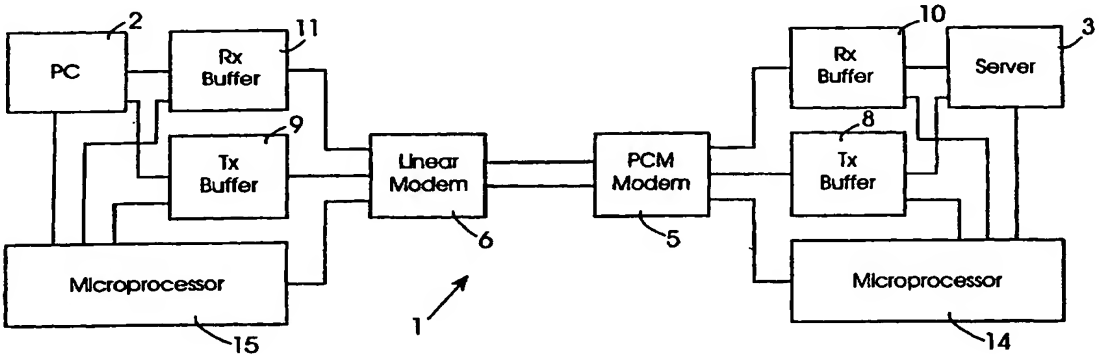
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
8 November 2001

[Continued on next page]

(54) Title: A METHOD FOR TRANSMITTING DATA BETWEEN RESPECTIVE FIRST AND SECOND MODEMS IN A TELECOMMUNICATIONS SYSTEM, AND A TELECOMMUNICATIONS SYSTEM



(57) Abstract: A telecommunications data transmission system (1) for communicating between a client's PC (2) and a server (3) of an internet service provider comprises transmission between a PCM codec modem (5) of the server (3) and a liner codec modem (6) of the PC (2). Data received by the PCM modem (5) for the server (3) is passed through a first receive data buffern (10) to the server (3), while a second receive data buffer (11) passes data from the linear modem (6) to the PC (2). First and second transmit data buffers (8, 9) hold data to be transmitted by the PCM modem (5) and the linear modem (6), respectively. First and second microprocessors (14, 15) control the data transmission rates of the modems (5, 6), respectively. During handshaking first and second data transmission rates are selected by the microprocessor (14, 15) for the PCM modem (5) and for the linear modem (6) for minimising echo in the transmission. The modem (5, 6) having to transmit the highest volume of data is selectively operated at its respective high data transmission rates, while the other of two modems (5, 6) is operated at its low data transmission rate. The microprocessors (14, 15) control the modems (5, 6) to avoid the two modems (5, 6) operating simultaneously at their respective high data transmission rates.

WO 01/20892 A3

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IE 00/00105

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M11/06 H04B3/23

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 605 107 A (AT & T CORP) 6 July 1994 (1994-07-06) the whole document	1-3, 5-14,19, 21-31, 33-42, 47,49-56
A	---	20,48
X	US 5 892 757 A (HANSEN CHRISTOPHER R ET AL) 6 April 1999 (1999-04-06) column 1, line 1 -column 4, line 26 column 6, line 33 - line 54 column 12, line 33 -column 16, line 22	1-4,7, 10-14, 19, 21-32, 35, 38-42, 47,49-56
	--- -/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 March 2001	30/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Brichau, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IE 00/00105

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 214 672 A (CHEN MICHAEL P ET AL) 25 May 1993 (1993-05-25) column 1, line 1 - line 57 column 19, line 23 - line 35	15,43

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IE 00/00105

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0605107 A	06-07-1994	US 5394392 A	28-02-1995
		CA 2102465 A	15-06-1994
		JP 6232937 A	19-08-1994
		MX 9307742 A	30-06-1994
US 5892757 A	06-04-1999	US 5579305 A	26-11-1996
		US 6094422 A	25-07-2000
US 5214672 A	25-05-1993	CA 2058450 A	07-10-1991
		EP 0476125 A	25-03-1992
		WO 9115900 A	17-10-1991

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 March 2001 (22.03.2001)

PCT

(10) International Publication Number
WO 01/20892 A2

(51) International Patent Classification[7]: H04M 11/06

(21) International Application Number: PCT/IE00/00105

(22) International Filing Date:
13 September 2000 (13.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
S990767 13 September 1999 (13.09.1999) IE

(71) Applicant *(for all designated States except US)*: **FERNWAY LIMITED** [IE/IE]; 63 Broomhill Drive, Tallaght, Dublin 24 (IE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **MCLAUGHLIN, Michael, Joseph** [IE/IE]; 12 Mount Eagle Park, Leopardstown, Dublin 18 (IE).

(74) Agent: **F.F. GORMAN & CO.**; 54 Merrion Square, Dublin 2 (IE).

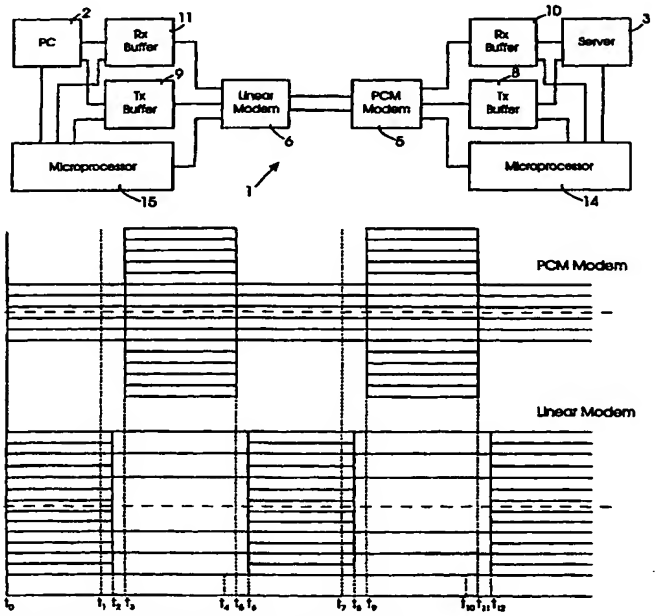
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *Without international search report and to be republished upon receipt of that report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A METHOD FOR TRANSMITTING DATA BETWEEN RESPECTIVE FIRST AND SECOND MODEMS IN A TELECOMMUNICATIONS SYSTEM, AND A TELECOMMUNICATIONS SYSTEM



(57) Abstract: A telecommunications data transmission system (1) for communicating between a client's PC (2) and a server (3) of an internet service provider comprises transmission between a PCM codec modem (5) of the server (3) and a liner codec modem (6) of the PC (2). Data received by the PCM modem (5) for the server (3) is passed through a first receive data buffem (10) to the server (3), while a second receive data buffer (11) passes data from the linear modem (6) to the PC (2). First and second transmit data buffers (8, 9) hold data to be transmitted by the PCM modem (5) and the linear modem (6), respectively. First and second microprocessors (14, 15) control the data transmission rates of the modems (5, 6), respectively. During handshaking first and second data transmission rates are selected by the microprocessor (14, 15) for the PCM modem (5) and for the linear modem (6) for minimising echo in the transmission. The modem (5, 6) having to transmit the highest volume of data is selectively operated at its respective high data transmission rates, while the other of two modems (5, 6) is operated at its low data transmission rate. The microprocessors (14, 15) control the modems (5, 6) to avoid the two modems (5, 6) operating simultaneously at their respective high data transmission rates.

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"A method for transmitting data between respective first and second modems in a telecommunications system, and a telecommunications system"

The present invention relates to a method for transmitting data between respective first and second modems in a telecommunications system, and the invention also relates to an improved telecommunications system.

In telecommunications systems echo can present problems. Echo typically arises where data is being transmitted at relatively high data transmission rates at relatively high power levels. It is known to provide echo cancellers for cancelling out echo, however in data transmission systems where digitised data is being transmitted, echo can cause significant problems as a result of distortion and corruption of data signals. This is a particular problem where data is being transmitted and received through a PCM modem due to the fact that received data signals are sampled at a relatively low resolution codec before an echo canceller has had the opportunity of removing echo from data signals. Telecommunications systems and methods for optimising between data transmission rates and echo are known. For example, in U.S. Patent Specification No. 5,289,459 of Brownlie a telecommunications system is described whereby during handshaking two data transmission rates are selected, one for transmitting in one direction and the other for transmitting in the other direction for minimising echo. However, in the transmission of digitised data between PCM modems, or between a PCM modem and a linear codec modem, the volume of data to be transmitted in the respective directions may vary from time to time. In other words, for part of the period of data transmission a high volume of data may have to be transmitted in one direction while the volume of data in the opposite direction may be relatively low, and during a subsequent part of the data transmission, the positions may be reversed whereby it may be necessary to transmit a large volume of data in the direction in which originally only a low volume data transmission was required, and vice versa. However, none of the known systems adequately provide for such a situation.

There is therefore a need for a method and a telecommunications system which accommodates varying volumes of data to be transmitted in respective opposite

directions in a telecommunications system, while at the same time minimising the effects of echo.

The present invention is directed towards providing such a telecommunications system and a method.

According to the invention there is provided a method for transmitting data between respective first and second modems in a telecommunications system wherein at least one of the modems is a PCM modem, wherein the method comprises the steps of selecting respective high and low data transmission rates for the respective modems during handshaking, the respective high and low data transmission rates for the respective modems being the same or different, and setting the modems to transmit at their respective high data transmission rates during transmission in response to the volume of data to be transmitted such that neither of the two modems are set to transmit at their respective high data transmission rates until the other of the two modems has been set to transmit at its low data transmission rate.

In one embodiment of the invention the high data transmission rates of the respective modems are different.

In another embodiment of the invention the low data transmission rates of the respective modems are different.

In a further embodiment of the invention the high and low data transmission rates of the first modem are selected by selecting corresponding high and low transmission power levels.

In a still further embodiment of the invention the high and low data transmission rates of the first modem are selected by selecting the spacing between signal levels of the data signal to be transmitted.

In another embodiment of the invention the high and low data transmission rates of the second modem are selected by selecting the spacing between signal levels of

the data signal to be transmitted.

In one embodiment of the invention the data signals are transmitted as constellation points.

In another embodiment of the invention the low data transmission rate of the first modem is selected by increasing the spacing between the constellation points.

In another embodiment of the invention the low data transmission rate of the second modem is selected by increasing the spacing between the constellation points.

In a further embodiment of the invention the respective modems are responsive to a switch signal received from the other of the two modems for switching from one data transmission rate to the other.

In another embodiment of the invention the second modem is responsive to the received switch signal received from the first modem for switching from its high data transmission rate to its low data transmission rate.

In a further embodiment of the invention each modem is responsive to the received switch signal for switching from its high data transmission rate to its low data transmission rate.

In a still further embodiment of the invention each modem is responsive to the received switch signal only if the volume of data to be transmitted by that modem no longer requires the high data transmission rate.

In one embodiment of the invention the switch signal is provided by a predetermined signal.

In another embodiment of the invention the switch signal comprises at least one illegal constellation point.

In a further embodiment of the invention the at least one illegal constellation point is followed by a predetermined sequence of legal constellation points.

In a further embodiment of the invention the switch signal comprises a predetermined sequence of legal constellation points.

In a still further embodiment of the invention the predetermined sequence of legal constellation points is an illegal sequence.

In another embodiment of the invention the switch signal comprises a predetermined frame of data signals.

In a further embodiment of the invention the switch signal comprises a reversed bit or byte.

Preferably, the respective high and low data transmission rates of at least one of the modems are determined in response to the amount of echo.

Advantageously, the high and low data transmission rates of the at least one modem are determined for minimising echo.

Ideally, the respective high and low data transmission rates are determined for the first modem in response to echo.

Advantageously, the respective high and low data transmission rates are determined for the second modem in response to echo.

In one embodiment of the invention the data signals transmitted between the respective first and second modems are digitally encoded data signals.

In another embodiment of the invention the first modem is a PCM codec modem.

In another embodiment of the invention the second modem is a linear codec modem.

In a still further embodiment of the invention the respective high and low data transmission rates of the respective modems are alterable during a retraining interrupt during data transmission.

Additionally, the invention provides a telecommunications data transmission system comprising respective first and second modems wherein at least one of the modems is a PCM modem, the respective first and second modems comprising handshaking means, wherein the respective handshaking means of each modem comprise a selecting means for selecting respective high and low data transmission rates for the respective modems during handshaking, the respective high and low data transmission rates for the respective modems being the same or different, and each modem comprises a means for setting its data transmission rate at its high data transmission rate in response to the volume of data to be transmitted such that neither of the two modems are set to transmit at their respective high data transmission rates until the other of the two modems has been set to transmit at its low data transmission rate.

In one embodiment of the invention the high data transmission rates of the respective modems are different.

In another embodiment of the invention the low data transmission rates of the respective modems are different.

In a further embodiment of the invention the selecting means of the first modem selects the high and low data transmission rates of the first modem by selecting corresponding high and low transmission power levels.

In another embodiment of the invention the selecting means of the first modem selects the high and low data transmission rates of the first modem by selecting the spacing between signal levels of the data signal to be transmitted.

In a further embodiment of the invention the selecting means of the second modem

selects the high and low data transmission rates of the second modem by selecting the spacing between signal levels of the data signal to be transmitted.

In one embodiment of the invention the data signals are transmitted as constellation points.

In another embodiment of the invention the selecting means of the first modem selects the low data transmission rate of the first modem by increasing the spacing between the constellation points.

In a further embodiment of the invention the selecting means of the second modem selects the low data transmission rate of the second modem by increasing the spacing between the constellation points.

In one embodiment of the invention each modem comprises a switch signal generating means for generating a switch signal in response to the volume of data to be transmitted by that modem, and the means for setting the data transmission rate of each modem being responsive to a switch signal received from the other of the two modems for switching the modem having received the switch signal from one data transmission rate to the other.

In another embodiment of the invention the means for setting the data transmission rate of the second modem is responsive to the received switch signal received from the first modem for switching from its high data transmission rate to its low data transmission rate.

In a further embodiment of the invention the means for setting the data transmission rate of each modem is responsive to the received switch signal for switching from its high data transmission rate to its low data transmission rate.

In a still further embodiment of the invention the means for setting the data transmission rate of each modem is responsive to the received switch signal only if the volume of data to be transmitted by that modem no longer requires the high data

transmission rate.

In one embodiment of the invention the switch signal is provided by a predetermined signal.

In another embodiment of the invention the switch signal comprises at least one illegal constellation point.

In a further embodiment of the invention the at least one illegal constellation point is followed by a predetermined sequence of legal constellation points.

In a still further embodiment of the invention the switch signal comprises a predetermined sequence of legal constellation points.

In one embodiment of the invention the predetermined sequence of legal constellation points is an illegal sequence.

In another embodiment of the invention the switch signal comprises a predetermined frame of data signals.

In a still further embodiment of the invention the switch signal comprises a reversed bit or byte.

Preferably, the selecting means for selecting the respective high and low data transmission rates of at least one of the modems selects the respective data transmission rates in response to the amount of echo.

Advantageously, the selecting means for selecting the high and low data transmission rates of the at least one of the modems selects the respective data transmission rates for minimising echo.

Ideally, the selecting means of the first modem selects the respective high and low data transmission rates for the first modem in response to echo.

In one embodiment of the invention the selecting means of the second modem selects the respective high and low data transmission rates for the second modem in response to echo.

In another embodiment of the invention the data signals transmitted between the respective first and second modems are digitally encoded data signals.

In one embodiment of the invention the first modem is a PCM codec modem.

In another embodiment of the invention the second modem is a linear codec modem.

In a further embodiment of the invention the selecting means of the respective first and second modems are operational for altering the respective selected high and low data transmission rates of the respective modems during a retraining interrupt during data transmission.

The advantages of the invention are many. By virtue of the fact that respective high and low transmission rates are selected during handshaking for the respective modems, between which data is to be transmitted, the modem from which the highest volume of data is to be transmitted can be set at its high data transmission rate, while the other modem is set to transmit data at its low data transmission rate. Additionally, as soon as the position reverses and the modem transmitting at its low data transmission rate requires to transmit a higher volume of data than the other modem, the modem which had been transmitting at the low data transmission rate can be set to transmit data at its high data transmission rate, after the other modem has been set to transmit its low data transmission rate. This, thus, leads to particularly efficient transmission of data, furthermore, minimises distortion and corruption of transmitted data. In particular the method and telecommunications system according to the invention are particularly suitable for use in a transmission system where at least one of the modems is PCM modem, and indeed where the other modem may also be a PCM modem, or a linear codec modem or the like.

The invention will be more clearly understood from the following description of some preferred embodiments thereof which are given by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a block representation of a telecommunications system according to the invention,

Fig. 2 is a timing chart illustrating the operation of the telecommunications system of Fig. 1, and

Fig. 3 is a timing chart illustrating the operation of the telecommunications system according to another embodiment of the invention.

Referring to the drawings and initially to Fig. 1 there is illustrated a telecommunications system according to the invention which is indicated generally by the reference numeral 1. In this embodiment of the invention data is being transmitted through the telecommunications system 1 between a PC 2 of a client and a server 3 of an internet service provider. First and second modems, namely, a first modem provided by a PCM codec modem 5 associated with the server 3, and a second modem, namely, a linear codec modem 6 associated with the PC 2 communicate the server 3 and the PC 2 through the telecommunications system 1. The data is digitised data and is transmitted between the modems 5 and 6 as a series of constellation points. First and second transmit data buffers 8 and 9, respectively, associated with the server 3 and the PC 2, respectively hold data to be transmitted from the server 3 and the PC 2 prior to the data being relayed to the corresponding PCM modem 5 and linear modem 6. First and second receive data buffers 10 and 11, respectively, receive data for the server and the PC 2, respectively, transmitted by the other of the server 3 and the PC 2. Respective first and second control means, namely, first and second microprocessors 14 and 15, respectively, control the operation of the PCM modem 5 and the linear modem 6 and their corresponding first and second transmit data buffers 8 and 9, as well as the first and second receive buffers 10 and 11, as will be described below. However, it will be appreciated that the first and second microprocessors 14 and 15 may be

incorporated in the corresponding modems 5 and 6, respectively, or the second microprocessor 15 could be implemented by the PC 2, and the first microprocessor 14 could be implemented by a computer controlling the server 3.

During handshaking test data is transmitted between the PCM modem 5 and the linear modem 6 under the control of the first and second microprocessors 14 and 15, respectively, for determining respective high and low data transmission rates for the PCM modem 5 and the linear modem 6 for minimising echo. A selecting means implemented by software in the first microprocessor 14 reads the results of the test data transmission between the PCM modem 5 and the linear modem 6, and selects a suitable high data transmission rate and a suitable low data transmission rate for the PCM modem 5 which minimises echo. A selecting means implemented by software in the second microprocessor reads the results of the test data transmission between the PCM modem 5 and the linear modem 6 and selects a suitable high data transmission rate and a suitable low data transmission rate for the linear modem 6 also for minimising echo. The high data transmission rates for the respective modems 5 and 6 may be the same or different, however, in general, they will be different, and the low data transmission rates selected for the PCM modem 5 and the linear modem 6 may likewise be the same or different, but typically, will be different. Methods for selecting a high and a low data rate for a modem for minimising echo will be well known to those skilled in the art. Once the respective high and low data transmission rates have been selected for the PCM modem 5 and the linear modem, and the remainder of the handshaking protocol has been completed, the telecommunications system is ready for use.

During transmission of data between the PC 2 and the server 3 respective monitoring means implemented by software in the microprocessors 14 and 15 monitor the corresponding transmit data buffers 8 and 9 and the corresponding receive data buffers 10 and 11. Each first and second microprocessor 14 and 15 comprises a means for generating a switch signal, which is implemented by software, in response to the microprocessor 14 or 15 detecting overflow of data from its corresponding transmit data buffer 8 or 9, if the corresponding modem 5 or 6 is operating at its low data transmission rate. The switch signal is a predetermined

signal as will be described below. Each first and second microprocessor 14 and 15 comprises a means for setting the data transmission rate of its corresponding modem 5 or 6 at its appropriate high or low data transmission rate in response to a received switch signal. The respective means for setting the data transmission rates are implemented in software in the corresponding microprocessor 14 and 15.

The mechanism by which the data transmission rates for the respective modems 5 and 6 are set will now be described. Assuming that the PCM modem 5 is set to transmit at its high data transmission rate, and the linear modem 6 is set to transmit at the low data transmission rate, and assuming further that the second transmit data buffer 9 associated with the linear modem 6 is commencing to overflow, on the second microprocessor 15 detecting overflow of the second transmit data buffer 9 indicating an increased volume of data to be transmitted by the PC 2 to the server 3 the second microprocessor 15 generates the switch signal and relays the switch signal to the linear modem 6 for transmission to the PCM modem 5 and reception by the first microprocessor 14. On the first microprocessor 14 receiving the switch signal, the first microprocessor 14 checks the status of the first transmit data buffer 8. Provided the status of the first transmit data buffer 8 indicates that the volume of data being transmitted by the server 3 does not require the PCM modem 5 to operate at its high data transmission rate then the first microprocessor 14 sets the PCM modem 5 to transmit at its low data transmission rate. On the second microprocessor 15 detecting the data being received by the second received data buffer 11 is being transmitted by the PCM modem 5 at its low data transmission rate the second microprocessor 15 sets the linear modem 6 to transmit at its high data transmission rate. In this embodiment of the invention the PCM modem 5 continues to transmit at its low data transmission rate and the linear modem 6 continues to transmit at its high data transmission rate until the first microprocessor 14 detects the first transmit data buffer 8 commencing to overflow. On an overflow situation being detected by the first microprocessor 14 in the first transmit data buffer 8, the first microprocessor 14 generates and transmits the switch signal through the PCM modem 5 to the linear modem 6 which is received by the second microprocessor 15. The second microprocessor 15 checks the status of the second transmit data buffer 9, and provided the status of the second transmit data buffer 9 indicates that the

volume of data to be transmitted by the PC 2 could be accommodated by the low data transmission rate of the linear modem 6, the second microprocessor 15 sets the linear modem 6 to transmit at its low data transmission rate. On the first microprocessor 14 detecting data being received by the first receive data buffer 10 being transmitted by the linear modem 6 at its low data rate, the first microprocessor 14 sets the PCM modem 5 to transmit at its high data transmission rate, and so operation of the telecommunications system 1 continues.

Referring now to Fig. 2 a timing chart for the operation of the telecommunications system 1 will now be described. Initially from time t_0 to t_2 the PCM modem is operating at its low data transmission rate, which in this embodiment of the invention is at a low power level. From time t_0 the linear modem 6 is operating at its high data transmission rate. At time t_1 the first microprocessor 14 determines that the first transmit data buffer 8 is commencing to overflow and transmits a switch signal to the second microprocessor 15 through the PCM modem 5 and the linear modem 6. After checking the second receive data buffer 11 the second microprocessor 15 determines that the linear modem 6 can be operated at its low data transmission rate, and at time t_2 sets the linear modem 6 to transmit at its low data transmission rate. In this embodiment of the invention the linear modem 6 is operated at the same power level during its high and low data transmission rates, however, during its low data transmission rate the spacing between the levels at which constellation points are transmitted is increased as can be seen in Fig. 2. At time t_3 on the first microprocessor 14 detecting from the first receive data buffer 10 that the data being transmitted by the linear modem 6 is being transmitted at its low data rate, the first microprocessor 14 sets the PCM modem 5 to transmit at its high data transmission rate, and in this embodiment of the invention increases the power level at which the PCM modem 5 is operating to a high power level, as can be seen in Fig. 2. When operating at its high data transmission rate the PCM modem 5 operates at a significantly higher power level than when operating at its low data transmission rate, however, the spacing between the levels at which the constellation points are transmitted remains unaltered from its low data transmission rate.

At time t_4 the second microprocessor 15 detects the second transmit data buffer 9

commencing to overflow indicating a high volume of data to be transmitted from the PC 2. The second microprocessor 15 transmits a switch signal through the linear modem 6 and the PCM modem 5 for reception by the first microprocessor 14. The first microprocessor 14 reads the first transmit data buffer 8 which indicates that the volume of data being transmitted by the server 3 does not require the PCM modem to transmit at its high data transmission rate, and at time t_5 the first microprocessor 14 sets the PCM modem 5 to operate at its low data transmission rate. The second microprocessor 15 on detecting from the second receive data buffer 11 that the PCM modem 5 is transmitting data at its low data transmission rate sets the linear modem 6 at time t_6 to operate at its high data transmission rate. As discussed above the power level at which the linear modem 6 operates between its high and low data transmission rate remains unchanged, however, the spacing between the levels at which constellation points can be transmitted is significantly increased thereby permitting data to be transmitted by the linear modem 6 at a significantly higher rate.

In this embodiment of the invention the spacing between the levels at which constellation points can be transmitted during the high data transmission rate of the linear modem 6 is set to accommodate a relatively high number of constellation points, while at its low data transmission rate the spacing between the constellation point level is such as to facilitate transmission of a lesser number of constellation points.

The operation of the telecommunications system 1 continues with the PCM modem 5 operating at its low data transmission rate and the linear modem 6 operating at its high data rate until time t_7. At time t_7 the first microprocessor 14 detects a high volume of data to be transmitted by the PCM modem 5 from the server 3, and the first microprocessor 14 transmits a switch signal which is responded to by the second microprocessor 15 setting the linear modem 6 to transmit at time t_8 at its low data transmission rate. At time t_9 having detected the change in data transmission rates in the linear modem 6, the first microprocessor 14 sets the PCM modem 5 to transmit at its high data rate until times t_{10}, t_{11} and t_{12} at which stage the position is again reversed.

In this embodiment of the invention if at any time a switch signal is received by either one of the microprocessors 14 or 15, and that microprocessor detects that its corresponding transmit data buffer 8 or 9 indicates that the volume of data to be transmitted is still high, the microprocessor which has received the switch signal will fail to respond to the switch signal until such time as the volume of data to be transmitted associated with that microprocessor has reduced to a level which could be accommodated by the modem transmitting at its low data transmission rate.

The switch signal may be any predetermined signal which is understood by the respective first and second microprocessors 14 and 15. Since the telecommunications system 1 is transmitting data as a series of constellation points, the switch signal may be provided by an illegal constellation point, or an illegal constellation point followed by a predetermined sequence of legal constellation points. Alternatively, the switch signal may be provided by a predetermined sequence of legal constellation points, or alternatively may be provided by a predetermined illegal sequence of legal constellation points. An illegal constellation point is a constellation point which would not be used in the communications protocol. An illegal sequence of constellation points is a sequence of constellation points which would not be used in the transmission protocol.

In general, there is a small amount of spare encoding capacity in communication protocols where some groups of legal constellation points are not normally used. One or more of these combinations could likewise be used as a switching signal.

A method for providing a switch signal which is specific to the protocol in use, could for example be provided by an inverted HDLC CRC or some other transformation of the CRC, for example, bit reversed, byte reversed, add/subtract a fixed number, or the like. Alternatively, a specific type of frame of data may be used.

Referring now to Fig. 3 a timing chart of a method according to an alternative embodiment of the invention for switching the modems 5 and 6 between their respective high and low data transmission rates will now be described. In this embodiment of the invention the first microprocessor 14 which is associated with the

PCM modem 5 controls switching of the respective modems 5 and 6 between their respective high and low data transmission rates. At time t_0 the PCM modem 5 is transmitting at its low data transmission rate and the linear modem 6 is transmitting at its high data transmission rate. At time t_1 the first microprocessor 14 determines from the first transmit data buffer 8 that the volume of data to be transmitted by the server requires the PCM modem 5 to operate at its high data transmission rate, and at time t_1 the first microprocessor 14 transmits a switch signal of any one of the type already described through the PCM modem 5 for reception by the second microprocessor 15 through the linear modem 6. At time t_2 the second microprocessor 15 receives the switch signal and at time t_3 sets the linear modem 6 to operate at its low data transmission rate and retransmits the switch signal back to the first microprocessor 15 through the linear modem 6 and the PCM modem 5. At time t_4 the first microprocessor 14 receives the returned switch signal and at time t_5 sets the PCM modem 5 to operate at the high data transmission rate. At time t_6 the first microprocessor 14 determines that it is no longer necessary for the PCM modem 5 to operate at its high data transmission rate and accordingly, at time t_6 transmits a switch signal to the second microprocessor 15 through the respective PCM and linear modems 5 and 6, respectively. At time t_7 having transmitted the switch signal the first microprocessor 14 sets the PCM modem 5 to operate at its low data transmission rate. At time t_8 the second microprocessor 15 receives the switch signal and at time t_9 sets the linear modem 6 to operate at its high data transmission rate.

It should be noted that in both methods for operating the telecommunications system 1 which have been described with reference to the timing charts of Figs. 2 and 3, the respective modems 5 and 6 are operated to avoid the two modems 5 and 6 simultaneously operating at their respective high data transmission rates.

While the telecommunications system 1 has been described as comprising a PCM codec modem and a linear codec modem, it will be appreciated that the system may be provided with two PCM codec modems.

While the communication in the telecommunications system described with reference to the drawings has been described as being between a client's PC and

the server of an internet service provider, it will be appreciated that the telecommunications system according to the invention may be used for communicating digital data between a client and any source, and between a PC and any other computer system or between two PCs or the like.

Claims

1. A method for transmitting data between respective first and second modems (5,6) in a telecommunications system (1) wherein at least one of the modems (5,6) is a PCM modem (5), characterised in that the method comprises the steps of selecting respective high and low data transmission rates for the respective modems (5,6) during handshaking, the respective high and low data transmission rates for the respective modems (5,6) being the same or different, and setting the modems (5,6) to transmit at their respective high data transmission rates during transmission in response to the volume of data to be transmitted such that neither of the two modems (5,6) are set to transmit at their respective high data transmission rates until the other of the two modems (5,6) has been set to transmit at its low data transmission rate.

2. A method as claimed in Claim 1 characterised in that the high data transmission rates of the respective modems are different.

3. A method as claimed in Claim 1 or 2 characterised in that the low data transmission rates of the respective modems are different.

4. A method as claimed in any preceding claim characterised in that the high and low data transmission rates of the first modem (5) are selected by selecting corresponding high and low transmission power levels.

5. A method as claimed in any preceding claim characterised in that the high and low data transmission rates of the first modem (5) are selected by selecting the spacing between signal levels of the data signal to be transmitted.

6. A method as claimed in any preceding claim characterised in that the high and low data transmission rates of the second modem (6) are selected by selecting the spacing between signal levels of the data signal to be transmitted.

7. A method as claimed in any preceding claim characterised in that the data

signals are transmitted as constellation points.

8. A method as claimed in Claim 7 characterised in that the low data transmission rate of the first modem (5) is selected by increasing the spacing between the constellation points.

9. A method as claimed in Claim 7 or 8 characterised in that the low data transmission rate of the second modem (6) is selected by increasing the spacing between the constellation points.

10. A method as claimed in any preceding claim characterised in that the respective modems (5,6) are responsive to a switch signal received from the other of the two modems (5,6) for switching from one data transmission rate to the other.

11. A method as claimed in Claim 10 characterised in that the second modem (6) is responsive to the received switch signal received from the first modem (5) for switching from its high data transmission rate to its low data transmission rate.

12. A method as claimed in Claim 10 or 11 characterised in that each modem (5,6) is responsive to the received switch signal for switching from its high data transmission rate to its low data transmission rate.

13. A method as claimed in Claim 11 or 12 characterised in that each modem (5,6) is responsive to the received switch signal only if the volume of data to be transmitted by that modem (5,6) no longer requires the high data transmission rate.

14. A method as claimed in any of Claims 10 to 13 characterised in that the switch signal is provided by a predetermined signal.

15. A method as claimed in Claim 14 characterised in that the switch signal comprises at least one illegal constellation point.

16. A method as claimed in Claim 15 characterised in that the at least one illegal constellation point is followed by a predetermined sequence of legal constellation points.

17. A method as claimed in Claim 15 or 16 characterised in that the switch signal comprises a predetermined sequence of legal constellation points.

18. A method as claimed in Claim 17 characterised in that the predetermined sequence of legal constellation points is an illegal sequence.

19. A method as claimed in any of Claims 10 to 18 characterised in that the switch signal comprises a predetermined frame of data signals.

20. A method as claimed in any of Claims 10 to 19 characterised in that the switch signal comprises a reversed bit or byte.

21. A method as claimed in any preceding claim characterised in that the respective high and low data transmission rates of at least one of the modems (5,6) are determined in response to the amount of echo.

22. A method as claimed in Claim 21 characterised in that the high and low data transmission rates of the at least one modem (5,6) are determined for minimising echo.

23. A method as claimed in Claim 21 or 22 characterised in that the respective high and low data transmission rates are determined for the first modem (5) in response to echo.

24. A method as claimed in any of Claims 21 to 25 characterised in that the respective high and low data transmission rates are determined for the second modem (6) in response to echo.

25. A method as claimed in any preceding claim characterised in that the data signals transmitted between the respective first and second modems (5,6) are digitally encoded data signals.

26. A method as claimed in any preceding claim characterised in that the first modem (5) is a PCM codec modem.

27. A method as claimed in any preceding claim characterised in that the second modem (6) is a linear codec modem.

28. A method as claimed in any preceding claim characterised in that the respective high and low data transmission rates of the respective modems are alterable during a retraining interrupt during data transmission.

29. A telecommunications data transmission system comprising respective first and second modems (5,6) wherein at least one of the modems (5,6) is a PCM modem (5), the respective first and second modems (5,6) comprising handshaking means, characterised in that the respective handshaking means of each modem (5,6) comprise a selecting means (14,15) for selecting respective high and low data transmission rates for the respective modems (5,6) during handshaking, the respective high and low data transmission rates for the respective modems (5,6) being the same or different, and each modem (5,6) comprises a means (14,15) for setting its data transmission rate at its high data transmission rate in response to the volume of data to be transmitted such that neither of the two modems (5,6) are set to transmit at their respective high data transmission rates until the other of the two modems (5,6) has been set to transmit at its low data transmission rate.

30. A transmission system as claimed in Claim 29 characterised in that the high data transmission rates of the respective modems (5,6) are different.

31. A transmission system as claimed in Claim 29 or 30 characterised in that the low data transmission rates of the respective modems (5,6) are different.

32. A transmission system as claimed in any of Claims 29 to 31 characterised in that the selecting means (14) of the first modem (5) selects the high and low data transmission rates of the first modem (5) by selecting corresponding high and low transmission power levels.

33. A transmission system as claimed in any of Claims 29 to 32 characterised in that the selecting means (14) of the first modem (5) selects the high and low data transmission rates of the first modem (5) by selecting the spacing between signal levels of the data signal to be transmitted.

34. A transmission system as claimed in any of Claims 29 to 33 characterised in that the selecting means (15) of the second modem (6) selects the high and low data transmission rates of the second modem (6) by selecting the spacing between signal levels of the data signal to be transmitted.

35. A transmission system as claimed in any of Claims 29 to 34 characterised in that the data signals are transmitted as constellation points.

36. A transmission system as claimed in Claim 35 characterised in that the selecting means (14) of the first modem (5) selects the low data transmission rate of the first modem (5) by increasing the spacing between the constellation points.

37. A transmission system as claimed in Claim 35 or 36 characterised in that the selecting means (15) of the second modem (6) selects the low data transmission rate of the second modem (6) by increasing the spacing between the constellation points.

38. A transmission system as claimed in any of Claims 29 to 37 characterised in that each modem (5,6) comprises a switch signal generating means (14,15) for generating a switch signal in response to the volume of data to be transmitted by that modem (5,6), and the means (14,15) for setting the data transmission rate of

each modem (5,6) being responsive to a switch signal received from the other of the two modems (5,6) for switching the modem having received the switch signal from one data transmission rate to the other.

39. A transmission system as claimed in Claim 38 characterised in that the means (14,15) for setting the data transmission rate of the second modem (6) is responsive to the received switch signal received from the first modem (5) for switching from its high data transmission rate to its low data transmission rate.

40. A transmission system as claimed in Claim 38 or 39 characterised in that the means (14,15) for setting the data transmission rate of each modem (5,6) is responsive to the received switch signal for switching from its high data transmission rate to its low data transmission rate.

41. A transmission system as claimed in Claim 39 or 40 characterised in that the means (14,15) for setting the data transmission rate of each modem (5,6) is responsive to the received switch signal only if the volume of data to be transmitted by that modem (5,6) no longer requires the high data transmission rate.

42. A transmission system as claimed in any of Claims 38 to 41 characterised in that the switch signal is provided by a predetermined signal.

43. A transmission system as claimed in Claim 42 characterised in that the switch signal comprises at least one illegal constellation point.

44. A transmission system as claimed in Claim 43 characterised in that the at least one illegal constellation point is followed by a predetermined sequence of legal constellation points.

45. A transmission system as claimed in Claim 42 characterised in that the switch signal comprises a predetermined sequence of legal constellation points.

46. A transmission system as claimed in Claim 44 or 45 characterised in that the predetermined sequence of legal constellation points is an illegal sequence.

47. A transmission system as claimed in Claim 42 characterised in that the switch signal comprises a predetermined frame of data signals.

48. A transmission system as claimed in any of Claims 42 to 48 characterised in that the switch signal comprises a reversed bit or byte.

49. A transmission system as claimed in any of Claims 29 to 48 characterised in that the selecting means (14,15) for selecting the respective high and low data transmission rates of at least one of the modems (5,6) selects the respective data transmission rates in response to the amount of echo.

50. A transmission system as claimed in Claim 49 characterised in that the selecting means (14,15) for selecting the high and low data transmission rates of the at least one of the modems (5,6) selects the respective data transmission rates for minimising echo.

51. A transmission system as claimed in Claim 49 or 50 characterised in that the selecting means (14) of the first modem (5) selects the respective high and low data transmission rates for the first modem (5) in response to echo.

52. A transmission system as claimed in any of Claims 49 to 51 characterised in that the selecting means (15) of the second modem (6) selects the respective high and low data transmission rates for the second modem (6) in response to echo.

53. A transmission system as claimed in any of Claims 29 to 52 characterised in that the data signals transmitted between the respective first and second modems (5,6) are digitally encoded data signals.

54. A transmission system as claimed in any of Claims 29 to 53 characterised in

that the first modem (5) is a PCM codec modem.

55. A transmission system as claimed in any of Claims 29 to 54 characterised in that the second modem (6) is a linear codec modem.

56. A transmission system as claimed in any of Claims 29 to 55 characterised in that the selecting means (14,15) of the respective first and second modems (5,6) are operational for altering the respective selected high and low data transmission rates of the respective modems (5,6) during a retraining interrupt during data transmission.

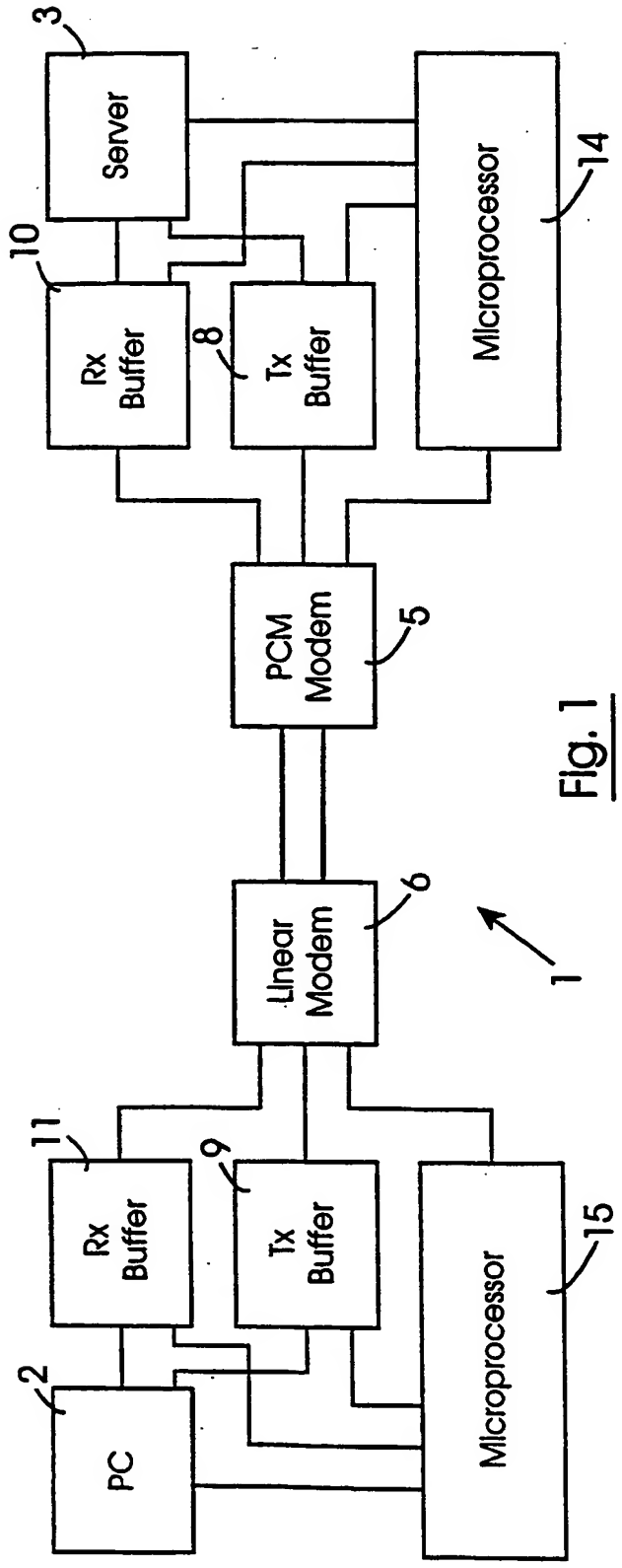
Server
3
Microprocessor
14
10
Rx Buffer
8
Tx Buffer
PCM Modem
5
Linear Modem
6
1
11
Rx Buffer
9
Tx Buffer
2
PC
Microprocessor
15

Fig. 1

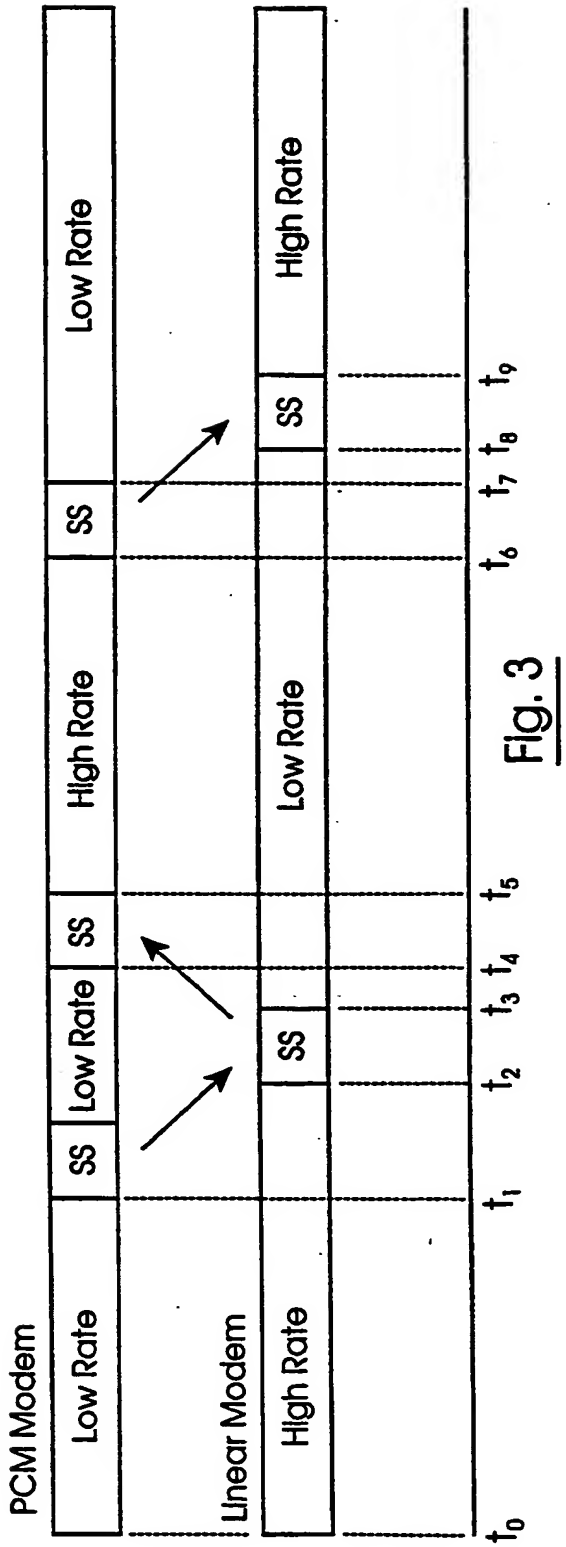
PCM Modem
Low Rate
SS
Low Rate
SS
High Rate
SS
Low Rate
Linear Modem
High Rate
SS
High Rate
t_0
t_1
t_2
t_3
t_4
t_5
t_6
t_7
t_8
t_9

Fig. 3

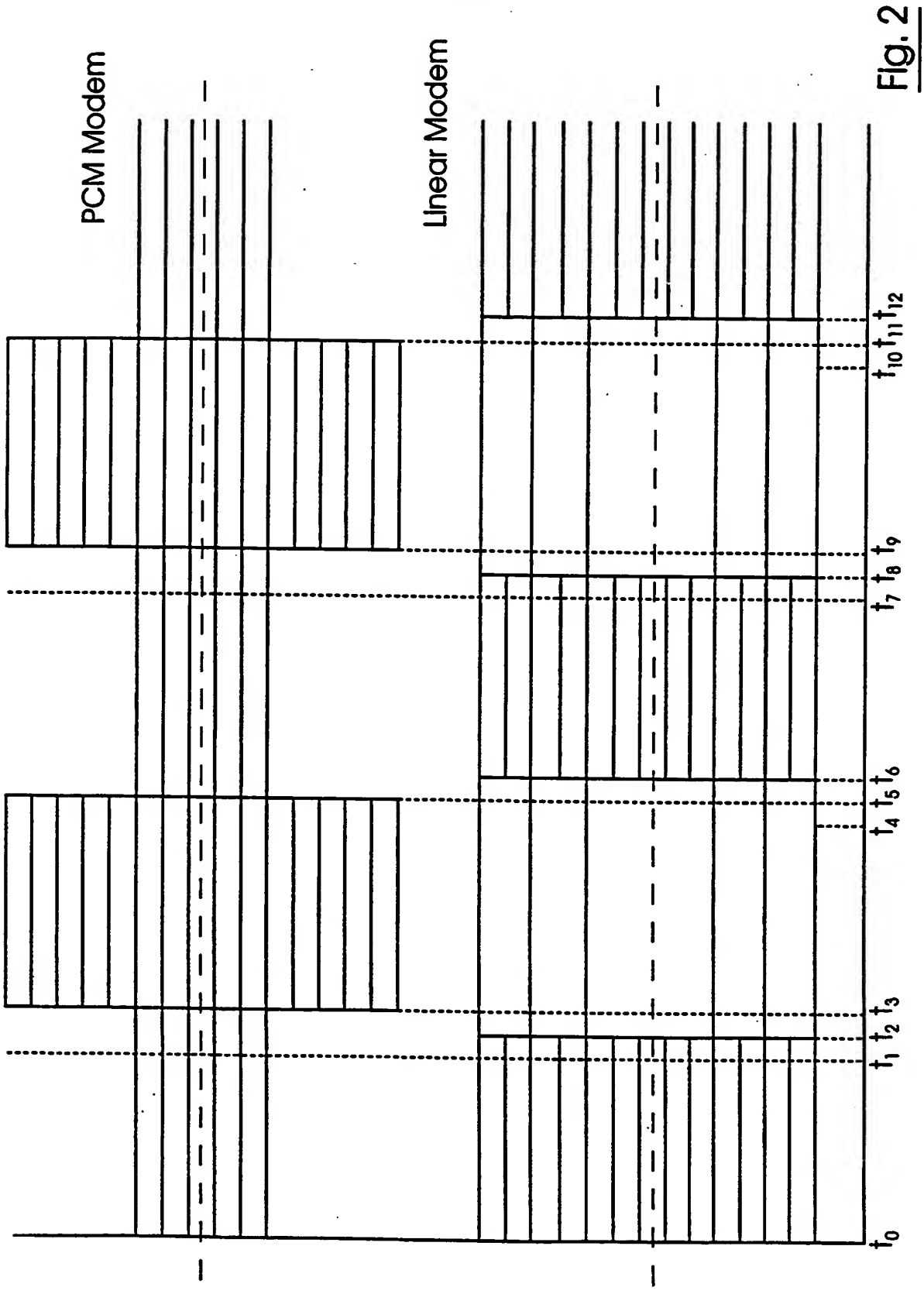

Fig. 2